

POPULAR **Computing** WEEKLY

27 May 1982 Vol 1 No 5

30p

Computer concerto

**Reviews: Mission
of the Deep**

**Vic-20
printer**

**Inside
the Spectrum**

Function keys on Vic-20



POPULAR Computing WEEKLY

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How to submit articles

Articles which are submitted for publication should not be more than 1000 words long.

All submissions should be typed and double-spaced should be left between each line.

Programs should, whenever possible, be computer printed.

All printed material is guaranteed to return every submitted article, so please keep a copy.

Announcements

Popular Computing Weekly cannot accept any responsibility for any errors in programs or publication, although we will always try to find to make sure programs work.

This Week



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Editorial

Why are so many of the games submitted to this magazine so Coast-tinny?

In the past couple of weeks there has been a great upsurge of programs with titles such as Falklands or Island Invasion.

It is understandable that the themes of so many programs should reflect national events.

These are still early days in home computing and most of us are still finding our way around our machines. So we choose themes which are close to hand.

But we must look to the future. Once we have all become more computer literate we will be able to reflect a greater imagination in our programs.

It will not be enough to be good at moving graphic boxes around the screen in fast moving chaotic patterns.

Programmers will have to show how to motivate the user, will have to understand how to play on the user's emotions, how to captivate the user's imagination, and hold them.

Good-tinny programs are an easy way out. Together we can raise the standard.

Next Week



Can you survive the Black Hole? The direct down beam on next week's event horizon. We dare you to be there.

News

NewBrain debuts at less than £200

Grandy Business Systems have launched the NewBrain, at a base model price of £199. With an 80 or 85 column display, the system is fully expandable to over 2 megabytes.

The NewBrain is based on an original period, taken to the National Enterprise Board by Clive Sinclair. Sinclair Laboratories was given the task of developing it and, finally, last year the project was sold to Grandy Business Systems, which has completed its development.

There are two models of the NewBrain available, both of which feature a full-size keyboard.

The basic Model A is built around the 68014 microprocessor with 128 KRAM and 256 KROM combined. It has dual numeric port, 16 and monitor ports, an expansion

port and VGA full-colour and printer ports.

Model A2 is the same as Model A but includes an optional three-page colour Screenfont 16 character, 24 segment display.

Plug-in memory expansion modules are available for both models, with 256K, 512K, 2M or 3.5M of RAM. A maximum of four 112K modules may be connected, giving a total memory of over 2 megabytes.

Proprietary software packages can be used, loaded via cassette or under CP/M, via disc.

An important feature of the NewBrain is its size. Measuring only 150 x 160 x 150, it takes up little more space than a telephone. Even with a full monitor, 80 cps printer and three floppy disc, the unit will only require 1.5 sq ft.

Andy Surtees, Grandy's



NewBrain's compact size.

Marketing Director, says: "The NewBrain is a professional personal computer which, with a full expansion keyboard, is designed for business, educational and educational applications, as well as the home use."

The NewBrain is scheduled for high-volume production, available in July. Model A is £199, Model A2 is £229. The 256K and 512K RAM modules are £75 and £125, respectively.

More information from Grandy Business Systems Ltd, Foxcroft Road, Teddington, Middlesex TW11 8TS.

The Bee-Box gives Vic extra bytes

The Vic20 expansion unit, manufactured by B&B Computers of Bolton, is now available.

John Blackburn, managing director of B&B Ltd (B&B's marketing company) explained that the unit is a spin-off from B&B's Virendra development.

The Bee-Box, as it is called, provides the Vic with extra memory and allows it to connect Teletext, Videotext and Prestel at 20 pages.

Inside the Bee-Box there are two ports — a 256 KRAM board and the 8445 VGA display colour-output board (which the board that fits B&B's for use with the PE1).

The 256K expansion unit uses 128 KRAM and a 16 K EPROM operating colour management and VIC monitor-only addressable RAM.

The lightweight nature of the main expansion in the Vic and is fitted with a socket to replace the Vic expansion socket which has been used to connect it.

The unit sells for £25 plus VAT and has a twelve-month guarantee, from B&B's, Prospect, Bolton BL3 5YJ.

Buzz words from Beebox

Beebox, the Independent National View Group for the BBC, since has published its first monthly newsletter.

Beebox One contains 26 pages, densely packed with information of interest to both the beginner and the more advanced user. There is also a review of the BBC machine, outlining special facilities, advantages and limitations.

David Graham of Beebox told *Popular Computing Weekly* that the site was to provide impartial advice and information to BBC users.

"We are just people who love the machines," he said.

Beebox now has more than 1,000 members and is keen to have more. Membership applications to Beebox, Dept 1, 25 Woodworth Road, London SW9 4TL.

Soft-sell on Prestel

Manufacture is trying to get more software on to Prestel, following its use in the British Telecom 2000 Prestel adapter competition.

Software manufacturers can win their programs through Prestel by contacting British Telecom on Freephone 2641.

Enquiries concerning the adapter to Manchester Ltd, 11 Division Close, Long Farm, St Albans, Herts AL3 9HT.

Putting the boot in

Now that summer is here, everybody's mind turns to... football! Sporting Forecasts, who already offers the 24 Football Forecast Program for the Apple, PET, Sharp, TRS80 and Video Color micro intend to produce a version for the BBC micro in time for the 1982-3 season.

Further information from Sporting Forecasts, Bureau of Information Science, Commerce House, High Street, Chalfont St Giles, Bucks.



The ZX81 machine with Space... think in Capital

Capital gives ZX81 a choice of printers

Capital Computers has produced a standardised interface for the ZX81, as reported last week.

The interface, designed by Sir G. Rumbold, allows the ZX81 to drive most makes of printer, thus providing greater versatility than that offered by Sinclair's own printer.

At ZX81, including VAT, the module has both BASIC and Commodore interfaces. There is 1K on-board memory and three routines in a 256 EPROM. The 14 pins in graphics key can be used with the EPROM printer.

The interface is designed to be used with Capital Computers Expansion Moduleboard or Mini-expansion board, with a maximum 544 available for RAM-BIOS addressing.

A package comprising, for example, 12K RAM, serial parallel printer interface, cable from interface to printer, and Mini-expansion board, suitable for connecting, and control of word-processing applications, is available for £250.

Contact Capital Computers Ltd, 100 Church Street, Luton, Beds.

Club Reports

Is your club involved in any special projects? Use this page to tell the world about it.

Helping people to get more from machines

Vernon Gifford describes how the Amateur Computer Club aids micro users.

Most micro users will have come across the Amateur Computer Club (ACC) at major shows where members co-ordinate club stands. Usually there are about 20 Clubs and User Groups (also Computer Towns) represented at shows with up to 40 machines of many different types in action.

This has become the ideal place to meet other enthusiasts for a wider exchange of views than is possible within individual groups. Prospective buyers find it particularly useful to be able to discuss the merits of computer equipment and software with regular users who have no commercial bias.

Hundreds of enquiries at ACC's own stand have been put in touch with their nearest local Club or specialist group through the ACC Database — which covers about 280 organisations, and which will shortly be available nationwide on Prestel. These show stands are organised by the very active David Arnold, who is also secretary of ACC.

The Club was founded in 1972 by Mike Lum, as a newsletter group. Later, with the help of Bob Warren, the group became active, organising visits and meetings. This led to the formation of other clubs around the country and as these developed, the ACC found itself with a new co-ordinating role to provide background services to the personal computer movement.

This, the oldest computer club in the world, began at a time when there were few micro.

It was only in 1979 that the first computer magazine appeared and so, for five years, the ACC had a unique position.

As the emphasis has switched from hardware and home-brew construction to off-the-shelf micro systems and software, the ACC has had to become more concerned with computer per-

formance. Members now require more information for their applications whether in homes, holidays, recreation or small businesses. Today the main function of a co-ordinating body like the ACC is to link the users to the information.

This has been achieved via the ACComputer edited by Derek and Diana Rodrod. It's made great strides and now Basil Bucher has strengthened the team.

Vernon Gifford takes care of contact with national educational bodies, the BBC, TV and radio, and the computer media.

As the ACC becomes recognised in this new role, it is more likely to be consulted as the representative body of the large personal computer population.

Club and User Group liaison is another important part of the ACC's programme. This enables groups to share their experiences and leads to national or regional activities in specific areas where individual clubs cannot raise sufficient numbers to justify getting speakers.

A two-way process

To encourage feedback the ACC offers to supply the six copies per year of the newsletter at the base cost of £2.50 to any club appointing a corresponding representative. Many clubs have already taken up the offer.

Various types of associate or group membership are under consideration, and some degree of regional development seems to be desirable. The first experiment — the Association of London Computer Clubs (ALCC) — which ran its first Easter Fair, under the leadership of Robin Bradbeer (who has joined the ACC Committee) has been extremely successful.

As these new activities expanded direct mailshots to clubs have complemented news in the ACComputer.

The ACC supports new groups dur-



Communicating ... Vernon Gifford

ing their formation, and, if necessary, until such time as they are self-sufficient.

National conferences or workshops are another interesting feature. Last November about 80 people attended a "Micro-Robotics" conference at Imperial College, displaying everything from Micro-Mouse to hydraulic mobile robots. A special User Group has been formed.

A second successful conference, on "The Telephone and Your Computer" (Presses and teletypes) was organised at Easter by the ACC Chairman, Peter Whittle. This also promises to spawn a special user Group.

Other ACC activities include a technical enquiry service and hardware, software and literature libraries.

Individual membership costs £4.50 for the year, including the six copies of the Newsletter. Facilities are available to negotiate a group membership for a whole club — which has already been taken up by the North London Hobby Computer Club. Their members all receive a copy of ACComputer — to which the Club adds its own newsletter. This reduces the workload of busy club officers, and saves duplication of effort.

For further information, contact Roger Steele (Membership and technical enquiries) at John's College, Oxford, OX1 3JF or Vernon Gifford (Liaison and Clubs) 1101 Belfry Road, London, SE25 6LH. Tel: 01-493 3267.

Write to Club Reports, Popular Computing Weekly, Holford House Court, 18 Whitcomb Street, London WC2E 7HF, with details of successes you have had with your club, with ideas for helping clubs along and with any news of special meetings. We look forward to hearing from you.

Computer

Enter the world of sound technology with this simple program which allows you to compose music on a piano-like keyboard

With Computer Concerto you can compose your own music. Using the sound generating facility of the vic-20 the program plays notes at the touch of a key.

It displays a representation of a section of the piano keyboard on the tv screen and produces one-and-a-half octaves of notes, including the sharps and flats.

When a selected key is depressed the sound is produced and the particular note chosen is indicated on the display by an asterisk below the relevant piano key.

To get the note C, press the C key and so on. The control key gives the sharps and flats and the shift key gives the upper octaves.

So, for example, when pressing B, the shift and control keys together make B# in the upper register.

The program

The program itself is quite simple and is most easily understood if it is considered in five parts.

1 Lines 120 to 136 print the keyboard display showing the tones and 248-2544
CDBFGABCE#F

2 Lines 256 to 245 are the data for producing the notes. It gives the frequency data. It gives the key data

and K# indicates the shift and control key data.

3 Lines 260 to 330 look at the keyboard and compare the values which have been entered with the data in Lines 248 to 254.

4 Lines 340 and 345 look at the character keys and the shift and control keys on the keyboard.

5 Lines 375 and 380 search through the data for the matching values.

When the correct data is located the program jumps out of the search loop to Line 400. Lines 400 to 405 then produce the desired note, N, selected from the data array, originally keyed-in as K1 and K2.

The vic-20 has three audio oscillators on board and the program produces a combination of two of them, 36874 and 36875, in Lines 400 and 405.

In Line 410 the amplitude control, 36875, is added and the top in Line 412 then produces a decaying amplitude. The combination of locations 36874, 36875 and 36876 produces a warm tone with some persistence, simulating the sound of a piano.

Lines 350 to 385 display an asterisk on the screen below the pitch played, so that you can see as well as hear the note.

This program is just a start to making music on the vic-20. It would be quite easy to adapt Computer Concerto in order to vary the lengths of the notes played and to store and retrieve them, making it possible to compose tunes and play them back. Such an adaptation would be well worth a try.

Whether you are a budding Bach or the next Handel, you should be no stepping you!

Specially written for
Popular Computing Weekly
by
Nick Hampshire



Concerto

```
10 SP#="C215PACES3"  
100 PRINT "ICLR=HOME,CCD3"  
105 PRINT " C D E F O R G C D E F"  
110 FOR S#1 TO 5  
115 PRINT "1 2 3 4 5 1 2 3 4 5 1 2 3 4 5 1"  
120 NEXT S  
125 FOR S=1705  
130 PRINT "1 1 1 1 1 1 1 1 1"  
135 NEXT S  
200 S1#="C225",K1(21),C2(121)  
205 DATA 195,34,0,0,195,34,2,198,18,0,201,18,2  
210 DATA 204,49,0,0,0,0,207,42,0,210,42,2,213,19,0  
215 DATA 215,19,2,217,17,0,219,17,2,221,35,0,0,0,0  
220 DATA 225,34,1,225,34,3,227,18,1,228,18,0  
225 DATA 228,45,1,0,0,0,231,42,1  
230 FOR S#0 TO 28  
235 READ A,B,C  
240 S1#="A",K1(30)=B,K2(30)=C  
245 NEXT S  
300 K3="C230",I2(30)  
305 K3="C230",A5(30)  
310 FOR S#0 TO 28  
315 IF K1=K3(30) THEN 320  
320 NEXT S  
325 GOTO 380  
330 IF K3=K5(30) THEN 350  
335 GOTO 320  
350 PRINT "IHOME,7031"  
355 PRINT SP#  
365 PRINT "C231",RIGHT$(SP#,30)*" ",SP#  
400 POKE 36874,K1(30)  
405 POKE 36875,K1(30)  
410 FOR J=0 TO 9 STEP -1  
415 POKE 36876,J  
420 FOR M#1 TO 20:NEXT M  
425 NEXT J  
430 GOTO 380
```



Reviews

software



Packman

Available from any Commodore dealer.
Price £8.95.

One of last year's successes in the arcade game world was *Packman*, a game in which you had to control a little monster roaming around a maze, gobbling up 'dots' (and thus gaining points) as he went around.

Lines were fairly being eaten by one of the four men running around after you, three lives was the usual limit, with a bonus life at some point in the scoring.

Other features included fruit, which would appear from time to time, and additional points were to be had by eating these delicacies.

There were always four special dots in the corners of the maze. Eating these changed the man chasing you from human into tumour, and you could then eat them as a further method of scoring points.

The reason for mentioning all of this is quite simple: the success of any reproduction of an arcade game for a small micro depends on how faithful that reproduction is.

Packman, by Hi-Tech, comes on cassette, and fits quite happily into the standard V64-80. The rules are not explained anywhere (presumably this assumes that you know the game from your local pub).

All they do tell you is how to control your monster, which proves to be somewhat difficult, as the four keys enabling you to move up, down, left, and right are all next to each other, and it's very easy to get into quite a tangle.

The maze on which the game is enacted does not use the whole V64 screen, although the program does use the now common practice of filling the whole of your V6 screen. Use of graphics and sound is not very good, and the game as a whole is quite slow to respond to your commands.

Summary

Some of the features of the original arcade game are missing or all in all it is not one of the three games currently available. PG

Cassette AD

Cassette AD, Hi-Tech, Street
Cheltenham, Glos.
Price £8.95

Do you like the strong informative title of the cassette? This is fast a double feature, containing the five programs, each from Cassettes A and B (20 each). Now you know, know too that Cassettes also sell cassette 2 four 16K programs for £10 and listings of most of their products.

The authors of the Cassettes AD programs show a commendable ingenuity in coping with 16 restrictions in pure Basic. None of the programs are novel, but they all work and are fairly good implementations of standard ideas.

Guess the third is 'similar to hangman, with no graphics'. Well, at least you're warned — I've seen hangman routines without graphics and no warning of it! The first hint is that the user enters the words to guess from a printed list where they are to be used — so the computer knows what they are, but you don't.

There's also *Towers of Babelia* (with five rings to move), versions of a *Mastermind*, *Simon*, *Pyramid*, *London Duckpond* and *Number Square* (3 x 3), and an impressive title *Post Machine*.

This is all very pleasant, then — but I quite honestly have to make 16 ZX81 versions of the standard games. Cassettes are fairly cheap, but without problems, and come with good documentation.

Summary

A fair-value compilation of nice BASIC versions of standard games. RJ



Visions

Available from any Commodore dealer.
Price £8.95.

Visions, by Bug Byte, is a significant improvement. Again available on cassette for the standard V64, it uses the whole of the V6 screen for the game, and envelopes

all of the features in the game we know and love. It is very well drawn and is quick to respond to your requests.

Test computers that what should have been a very good program. As in the Hi-Tech game, the keys for moving your man are next to each other, making life pleasant to say the least. Secondly, the background music (there is no difference in notes when different events take place in the game) is enough to send you looking for the nearest cat to jump off, depressing is not the word.

Summary

If you've got nimble fingers, and a volume control on your set, you're in for an enjoyable time with this particular cassette. PG

Mission Of The Deep

Blackstone, 28 Spina Close, Rye, East, West Midlands.
Price £10.00

This is one of those awful 'flood graphics adventure' games — I have to state that for the game. As with all adventures you don't know where you are, what you're doing, or how to do it.

In this case the maze is hidden until the end and the fence makes jump out at you with long warning and little chance of escape. It's addictive for millions, the unemployed and other persons of leisure.

The program starts rather strangely, with *SCACED* — PRESS ANY KEY TO RUN. (I'm not sure what happens if it doesn't load). After that you're straight into deep black water, on your own.

The accompanying notes do provide some sort of guidance to the three levels of play. I'm no doubt that some real advice must say that these notes are disproportionately over inflated, but in reality they give just about adequate help for those men to such experiences. They tell you how to breathe for instance — most useless.

It's not for me to tell you how to get to the bottom — of the program I mean. So that doesn't leave much for me to tell you.

Personally I prefer *Blackstone's* animated graphics games, some of which are superb. All the same this is as good an example of 'flood graphics adventure' as any I've seen, and while the graphics don't come up to Atari standards, they'll do.

Mission Of The Deep is a Basic program taking up some 10K of RAM. It loads easily and is appealing to lots of all ages.

Summary

An excellent 1981 example of the flood graphics adventure genre of computer game. No problem if you're into such things. RJ

Reviews

hardware

Vic 1515 Printer

Available from Commodore dealers.
Price \$225.

Why Commodore should make the price of the peripherals such as the mini-printer as the 1515 also drive considerably greater economy than the price of the VIC 1500 is a mystery best known to Commodore. However, we're stuck with it, so what do you get for your \$225 when you buy the VIC printer?

The printer connects up to the serial port on the VIC, and thus, as with the VIC 1500 drive, can be daisy-chained to other serial bus devices.

This is not quite as neat as it might seem, as the printer has a switch on the front enabling you to change the device number to be either 4 or 5. Consequently two different printers can have two different device numbers and be used for varying functions.

The switch also allows you to run the printer through a self-diagnosis test, which simply prints out all the possible characters (ASCII) generated from the VIC keyboard.

It is a 30 character per second uni-directional printer, using a five x seven-dot matrix. Capable of printing out all the graphics you can also have individual dot-addressable graphics, although this does tend to wear the print head rather rapidly.

Standard paper size is 80 columns, but unfortunately it takes non-standard size master heat stationery, which is quite difficult to get hold of — surprising in a peripheral for a machine aimed at the consumer market.

The quality of the output when in upper case mode is quite good, but switching into lower case produces some odd results.

The letter p for instance (there are others) looks very much the same in both upper and lower case, thus making readability somewhat difficult. As the main function of a printer is to reproduce what would otherwise appear on the screen, this is something that Commodore ought to be looking at.

There is a outline in the manual to describe the contents of the screen as to the printer, a nice touch.

There are 12 control codes available on the printer, and two accessory addresses for sending whatever you want to be in, cursor up mode or cursor down mode. These enable you to print in both upper and lower case at the same time.

The control codes give you access to both features as double width characters, reverse feed, user definable characters and so on.

With a print speed of only 30 characters

per second (not a long program can become particularly tedious. It is also an exceedingly noisy printer. If you do get a long listing to do, go outside, make yourself a cup of coffee and let the printer get on with it.

Summary

It is an expensive, noisy, slow printer but with fairly clear output. It does have some interesting features like the character coding. However, as it's just about the only printer on the market at the moment you haven't got a lot of choice.

PH

IBM QWERTY Keyboard

Computer Keyboards, Cambridge Park,
Hendon Road, Ascot, Bucks. Tel
0344 746661.

Price £28.95 (assembled version £31.00),
plus £7.50.

There's not an ordinary IBM keyboard with 82 push button keys, but a professional QWERTY keyboard converted to suit with the 2381.

The QWERTY keyboard is the type seen on a typewriter and the version for the 2381 also includes a space bar. The keys are also laid out in the stepped fashion of a typewriter, making the feel of the keys easier to the touch point.

The keys are the same as those found on many other computer terminals and thus have a reputation for long life. The key tops are covered with clear plastic covers under which can be placed the British signs and symbols.

There are six extra keys (three on each side) which can be wired up as user definable keys like the BBC machine it is not a port attached.

The keyboard size is 18" x 4 1/2" x 2" and can either be mounted as supplied (with rubber feet) or in an aluminum case. The case can be used to house the 2381's printed-circuit board and also provided is a metal strap to clamp the 2381 to the main PCB to the case.

Conversion to the 2381 is done via a set of plastic strips which plug into sockets on the keyboard. This means that there is no soldering required if you buy the assembled version.

The improvement in speed is usually in the range of 50 per cent depending on your typing speed. There is a limit on the speed at which keyboard strikes can be made of 10 characters a second, which is set by the 2381. If you try to beat it then some errors will be registered in the computer.

This keyboard is one of the best I have seen as it allows people who have used a typewriter keyboard before to ease their inputting smoothly. It can also speed up

games to make it easier to beat the computer!

The kit is fairly easy to construct as all keys are in one big block and there is no way you can get them to fit in the wrong way round. The 2381, when mounted inside the case, attaches the IBM pack beautifully as the kit is fairly neat in this case.

BA

Fun with Microcomputers

By Donald D. Swanson
Hayward Books, 108 pages paperback
£5.45.

This is the type of book that most suit well to the casual looking browser — 44 pages filled with cartoons, plenty of program listings and a colorful cover. The price though, may be rather off-putting (yet this is £5.45 in America, where it comes from, which explains the much up or down printed across the Atlantic).

When the casual purchaser unseals the package in the comfort of his/her own home, however, second impressions are likely to be less appealing.

The colorful cover includes, 'Painless programming for kids and adults — no experience required! The games, puzzles, and problems in this book introduce you to programming with BASIC quickly.

There are two ways to learn programming — with understanding and without it. Both may be painful or painless, fun or dull. In essence, this book, a reprinted issue of one called Fun With Computers and BASIC (1977) does not go too much for understanding, not is using it a festival of fun.

Swanson starts off with a few chapters of theory. His language is casual but not straightforward. His facts are not all beyond dispute. For example, A microcomputer is an extremely small electronic component such as a transistor or a diode. These components act as on-off switches.

Then there is an introduction to BASIC programming — in eighteen pages, not bad, but, as I say, not concerned overly with understanding.

The rest of the material is listings and programming tasks. There are 62 of these, a few being more. Few listings take up more than about a page, they are in non-graphics terminal-style BASIC and tend to be mathematically-based.

I wouldn't recommend anyone to buy this book. At the same you may get some program ideas from it — induce your local library to get a copy.

Summary

This little book does not tell us, unless you know it is rather superficial and out-of-date but contains a few useful listings. RJ

 commodore

COMPUTING

Own or use a Pet or a Vic? Fed up with being ignored by all the traditional monthly magazines? Fed up with listings which are too simple or simply do not work?

You need Commodore computing, the new monthly magazine. It is published by Nick Hampshire, author of *The Pet Revealed*, *Pet Graphics*, *A Library Subroutines* and the *Vic Revealed*. Each issue is packed with advanced advice on how to make the most of your computer, whether you use a Pet or a Vic, and whatever your application. Software, hardware, machine code, games, business use — it is all covered in every issue.

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Open Forum

Open Forum is for you to publish your programs and ideas.

It is important that your programs are bug free before you send them in. We cannot test all of them. Contributions should be sent to: Popular Computing Weekly, Redwood Court, 17 Whitworth Street, London W1 4JH 7AP.

Print using routine

on 13B

The DATA BANK BOOK's PRINT USING instruction. The PRINT USING instruction is particularly useful for tabulating a lot of mixed alpha-numerical data, when the numbers have to have the decimal points lined up in columns. It is also useful to be able to specify the number of decimal places to be printed, regardless of the precision of the number.

The listing shown in figure 1 contains a PRINT USING routine in lines 7000 to 9270.

Lines 30 to 470 explain how to use the routine, and lines 1000 to 1400 contain a demonstration program to show the routine in use. Figure 2 shows the output from a run of this program — the data is quite arbitrary.

In order to use the PRINT USING routine, you must first specify the format required.

This is done by setting up Z5 to the desired format. Z5 represents a line across the screen and thus should not normally be more than 30 characters in length. "B" is used to indicate where literal strings are to be printed and "-" is used to indicate where numbers are required.

The position of the decimal point (if any) is indicated by a ".". The number of places of decimals to be printed is controlled by the number of "" after the ".". For example values from -8.00 to 99.99 are allowed by " ". Outside this range (ie the range specified by the number of " in Z5) error 0 will result.

Any characters in Z5 other than B or . will be printed as they stand in the positions occupied in Z5.

Secondly, you must assign the data to be printed to the string Y5. Each item of data must match that expected in Z5 and should be separated by a comma (,). Numbers or numerical variables should be assigned using the STR\$ function and all data should

YOUR PROGRAM COULD WIN A PRIZE!

Each week the editor opens through all the programs that you send to Open Forum in order to find the Program of the Week.

The author of that program will qualify for £500.00, the usual fee we pay for published programs (the usual fee is £75).

Throughout the end of the month the first best programs of the week go forward to our amazing Program of the Month contest, for which there is a £750 prize.

This month the first prize is a super Z5 printer, worth £20.00! And at the end of the year, all the best Programs of the Month will be entered in the super national competition, Program of the Year, to send in your program today!

Programs which are most likely to be considered for the Star Prize will be computer printed and accompanied by a cassette.

The programs will be well documented, the documentation being typed with a double spacing between each line. The documentation should start with a general description of the program and then give some detail of how the program has been constructed and of its special features.

Longer programs (a Z5 Printer should be for micro-computer lengths and stuck down on to white paper). Please enclose a self-addressed envelope.

be linked together using the "+" sign. Y5 must end with a comma.

For example, see lines 1310 and 1340 and 1360-1380 in figure 1.

Lastly, to print a line of data, call the routine at line 7000, a GOSUB 7000.

The program routine uses the following variables:

PRD — factor to generate the required number of decimal places.

DECPNT — points to the decimal point in Z5.

DP — points to the decimal point in Z5.

PLACES — number of decimal places to be printed.

Z5 — a string to hold number to be printed.

Y5 — a string to hold data.

Z5 — a string specifying the format.

1 for literal.

1 for numbers.

1 for decimal point.

anything else is printed unchanged.

Lines 7000-7070 scan Z5, characterised by characters for B or .

Line 7040 detects the start of a string. Strings are "left justified". The routine at line 8040 to 8270 is called to print the string, padding out or truncating as necessary to the exact number of B or Z5.

Line 7060 detects where the start of a number is to be printed. The routine at lines 8000-8070 is called to print the number, if the width of the field Z5 is inadequate, error 0 will result.

Line 7080 will print the character in Z5 if it is neither a B nor a .

Line 7090 will cause the next call to the routine to start a fresh line.

String handling routine

Lines 8000 sets Y to point to the first character of Y5.

Lines 8010-8030 print a character and increments Y to point to the next character.

Lines 8040-8060 check whether another character is to be printed (B in Z5). If the end of Z5 is reached, or if there is no B, printing will stop and control will pass to line 8140 to truncate the string.

Line 8080 checks whether the string in Y5 is shorter than the space allowed, and if so jumps to line 8170 to 'pad' out the field with spaces.

Truncate

Lines 8140-8160 scan to the end of the string in Y5 (indicated by the J). Then truncate the string.

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Leave NTFS discards from '00' the item of data, so that the next item of data is at the start of '01'.

Line 4000 skips from Y6 the item of data, so that the next item of data is at the start of Y6.
Lines 4000-4006 pad out the field with spaces until 25 bytes out of 3 at the end of 25 is reached.

Figure 1

Line 6030 sets γ to point to the first occurrence of '0'.

11. **Answer: D** The patient is a 40-year-old male with a 10-year history of type 2 diabetes mellitus. He has been taking insulin for the past 5 years. His current HbA1c is 8.5%. He is also taking metformin 1000 mg twice daily. He has been experiencing frequent hypoglycemic episodes, particularly at night. His symptoms include sweating, tremor, and palpitations. He has been unable to eat or drink during these episodes. His blood glucose levels during these episodes are typically below 40 mg/dL. He has been taking 15 g of glucose tablets to treat these episodes. He is concerned about his ability to manage his diabetes and is seeking medical advice.

Line 1004 checks whether the first character is a "." (for value less than 1).

Line 5000-5009 assigns 80 to the variable `id` in the decimal code.

Line 1189 says the position of the decimal point.

Linux 0.0.18-0.100 assigns the remaining place of three characters.

Line: 2158 seconds from 00:00:00
 from 00:00:00 to 00:00:00

Liapp: 01000-0000 find the position of the document code in 79.

Line: 218 - changing attribute Step field to
name: step, type: text, value: 1

Large: 0000-23 and 00-00-0070 and
the remainder of 00-0000-0000.

Line 104 calculates the multiplying factor **MF**.

Line 1124 prints the number in the required position, aligns the decimal point, and prints the required number of decimal places.

Linux 6.000 adds a `no` point to the need
observed in 75.

100

100

Here are four programs to show the 386 Micro graphics in operation. The first one selects elements of the string. All pointed in line 501 to produce a balanced, uniform output.

The second program, Coloured Lace, is based on the first one, but it uses a string of ball shapes and squares, producing quite a different result.

The third program, *Forecast*, based on a program by Alastair Gourlay, uses the spring defined in the FW in an unexpected way to produce more balanced outputs. From time to

[illegible]

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Open Forum

Graphics

By Tim Hartwell

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927 REM:
928 REM:
929 REM:
930 REM:
931 REM:
932 REM:
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986 REM:
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988 REM:
989 REM:
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993 REM:
994 REM:
995 REM:
996 REM:
997 REM:
998 REM:
999 REM:
1000 REM:

```

time the program will clear the screen (see line 240) to start all over again.

The fourth program, *Sticks*, is based on a routine which originally plotted an oval in Mode 4. The program chooses the centre point of the oval, and its height and width randomly, then plots the oval around that, using a random step size (see line 120) based on the number produced in line 110.

Lines 70 and 80 determine whether or not the plotted shape will be moved slightly up, down, left or right before being re-plotted.

The resultant shape, which varies every time you run the program, resembles a solid figure, which explains the title.

An average peak

by JOHN

The Z80 manual explains how to find what byte is at a given ROM address, and these values vary between 0 and 255. It is at present to know what the average ROM byte value is, and what is the total numerical value of all the bytes, up to a given address.

This can be rapidly calculated by the following program (for 1K RAM). To avoid the program 'blowing up' at the address 0, the average peak value in the ROM is defined as:

```

TOTAL, byte
average =
  (total address + 1)

```

```

1 REM: PEAK, calculated for ROM
2 REM: ADDRESS: 1000, 1001, 1002, 1003, 1004
3 REM: 1005, 1006, 1007, 1008
4 REM: 1009, 1010, 1011, 1012
5 REM: 1013, 1014, 1015, 1016
6 REM: 1017, 1018, 1019, 1020
7 REM: 1021, 1022, 1023, 1024
8 REM: 1025, 1026, 1027, 1028
9 REM: 1029, 1030, 1031, 1032
10 REM: 1033, 1034, 1035, 1036
11 REM: 1037, 1038, 1039, 1040
12 REM: 1041, 1042, 1043, 1044
13 REM: 1045, 1046, 1047, 1048
14 REM: 1049, 1050, 1051, 1052
15 REM: 1053, 1054, 1055, 1056
16 REM: 1057, 1058, 1059, 1060
17 REM: 1061, 1062, 1063, 1064
18 REM: 1065, 1066, 1067, 1068
19 REM: 1069, 1070, 1071, 1072
20 REM: 1073, 1074, 1075, 1076
21 REM: 1077, 1078, 1079, 1080
22 REM: 1081, 1082, 1083, 1084
23 REM: 1085, 1086, 1087, 1088
24 REM: 1089, 1090, 1091, 1092
25 REM: 1093, 1094, 1095, 1096
26 REM: 1097, 1098, 1099, 1100
27 REM: 1101, 1102, 1103, 1104
28 REM: 1105, 1106, 1107, 1108
29 REM: 1109, 1110, 1111, 1112
30 REM: 1113, 1114, 1115, 1116
31 REM: 1117, 1118, 1119, 1120
32 REM: 1121, 1122, 1123, 1124
33 REM: 1125, 1126, 1127, 1128
34 REM: 1129, 1130, 1131, 1132
35 REM: 1133, 1134, 1135, 1136
36 REM: 1137, 1138, 1139, 1140
37 REM: 1141, 1142, 1143, 1144
38 REM: 1145, 1146, 1147, 1148
39 REM: 1149, 1150, 1151, 1152
40 REM: 1153, 1154, 1155, 1156
41 REM: 1157, 1158, 1159, 1160
42 REM: 1161, 1162, 1163, 1164
43 REM: 1165, 1166, 1167, 1168
44 REM: 1169, 1170, 1171, 1172
45 REM: 1173, 1174, 1175, 1176
46 REM: 1177, 1178, 1179, 1180
47 REM: 1181, 1182, 1183, 1184
48 REM: 1185, 1186, 1187, 1188
49 REM: 1189, 1190, 1191, 1192
50 REM: 1193, 1194, 1195, 1196
51 REM: 1197, 1198, 1199, 1200
52 REM: 1201, 1202, 1203, 1204
53 REM: 1205, 1206, 1207, 1208
54 REM: 1209, 1210, 1211, 1212
55 REM: 1213, 1214, 1215, 1216
56 REM: 1217, 1218, 1219, 1220
57 REM: 1221, 1222, 1223, 1224
58 REM: 1225, 1226, 1227, 1228
59 REM: 1229, 1230, 1231, 1232
60 REM: 1233, 1234, 1235, 1236
61 REM: 1237, 1238, 1239, 1240
62 REM: 1241, 1242, 1243, 1244
63 REM: 1245, 1246, 1247, 1248
64 REM: 1249, 1250, 1251, 1252
65 REM: 1253, 1254, 1255, 1256
66 REM: 1257, 1258, 1259, 1260
67 REM: 1261, 1262, 1263, 1264
68 REM: 1265, 1266, 1267, 1268
69 REM: 1269, 1270, 1271, 1272
70 REM: 1273, 1274, 1275, 1276
71 REM: 1277, 1278, 1279, 1280
72 REM: 1281, 1282, 1283, 1284
73 REM: 1285, 1286, 1287, 1288
74 REM: 1289, 1290, 1291, 1292
75 REM: 1293, 1294, 1295, 1296
76 REM: 1297, 1298, 1299, 1300
77 REM: 1301, 1302, 1303, 1304
78 REM: 1305, 1306, 1307, 1308
79 REM: 1309, 1310, 1311, 1312
80 REM: 1313, 1314, 1315, 1316
81 REM: 1317, 1318, 1319, 1320
82 REM: 1321, 1322, 1323, 1324
83 REM: 1325, 1326, 1327, 1328
84 REM: 1329, 1330, 1331, 1332
85 REM: 1333, 1334, 1335, 1336
86 REM: 1337, 1338, 1339, 1340
87 REM: 1341, 1342, 1343, 1344
88 REM: 1345, 1346, 1347, 1348
89 REM: 1349, 1350, 1351, 1352
90 REM: 1353, 1354, 1355, 1356
91 REM: 1357, 1358, 1359, 1360
92 REM: 1361, 1362, 1363, 1364
93 REM: 1365, 1366, 1367, 1368
94 REM: 1369, 1370, 1371, 1372
95 REM: 1373, 1374, 1375, 1376
96 REM: 1377, 1378, 1379, 1380
97 REM: 1381, 1382, 1383, 1384
98 REM: 1385, 1386, 1387, 1388
99 REM: 1389, 1390, 1391, 1392
100 REM: 1393, 1394, 1395, 1396
101 REM: 1397, 1398, 1399, 1400
102 REM: 1401, 1402, 1403, 1404
103 REM: 1405, 1406, 1407, 1408
104 REM: 1409, 1410, 1411, 1412
105 REM: 1413, 1414, 1415, 1416
106 REM: 1417, 1418, 1419, 1420
107 REM: 1421, 1422, 1423, 1424
108 REM: 1425, 1426, 1427, 1428
109 REM: 1429, 1430, 1431, 1432
110 REM: 1433, 1434, 1435, 1436
111 REM: 1437, 1438, 1439, 1440
112 REM: 1441, 1442, 1443, 1444
113 REM: 1445, 1446, 1447, 1448
114 REM: 1449, 1450, 1451, 1452
115 REM: 1453, 1454, 1455, 1456
116 REM: 1457, 1458, 1459, 1460
117 REM: 1461, 1462, 1463, 1464
118 REM: 1465, 1466, 1467, 1468
119 REM: 1469, 1470, 1471, 1472
120 REM: 1473, 1474, 1475, 1476
121 REM: 1477, 1478, 1479, 1480
122 REM: 1481, 1482, 1483, 1484
123 REM: 1485, 1486, 1487, 1488
124 REM: 1489, 1490, 1491, 1492
125 REM: 1493, 1494, 1495, 1496
126 REM: 1497, 1498, 1499, 1500
127 REM: 1501, 1502, 1503, 1504
128 REM: 1505, 1506, 1507, 1508
129 REM: 1509, 1510, 1511, 1512
130 REM: 1513, 1514, 1515, 1516
131 REM: 1517, 1518, 1519, 1520
132 REM: 1521, 1522, 1523, 1524
133 REM: 1525, 1526, 1527, 1528
134 REM: 1529, 1530, 1531, 1532
135 REM: 1533, 1534, 1535, 1536
136 REM: 1537, 1538, 1539, 1540
137 REM: 1541, 1542, 1543, 1544
138 REM: 1545, 1546, 1547, 1548
139 REM: 1549, 1550, 1551, 1552
140 REM: 1553, 1554, 1555, 1556
141 REM: 1557, 1558, 1559, 1560
142 REM: 1561, 1562, 1563, 1564
143 REM: 1565, 1566, 1567, 1568
144 REM: 1569, 1570, 1571, 1572
145 REM: 1573, 1574, 1575, 1576
146 REM: 1577, 1578, 1579, 1580
147 REM: 1581, 1582, 1583, 1584
148 REM: 1585, 1586, 1587, 1588
149 REM: 1589, 1590, 1591, 1592
150 REM: 1593, 1594, 1595, 1596
151 REM: 1597, 1598, 1599, 1600
152 REM: 1601, 1602, 1603, 1604
153 REM: 1605, 1606, 1607, 1608
154 REM: 1609, 1610, 1611, 1612
155 REM: 1613, 1614, 1615, 1616
156 REM: 1617, 1618, 1619, 1620
157 REM: 1621, 1622, 1623, 1624
158 REM: 1625, 1626, 1627, 1628
159 REM: 1629, 1630, 1631, 1632
160 REM: 1633, 1634, 1635, 1636
161 REM: 1637, 1638, 1639, 1640
162 REM: 1641, 1642, 1643, 1644
163 REM: 1645, 1646, 1647, 1648
164 REM: 1649, 1650, 1651, 1652
165 REM: 1653, 1654, 1655, 1656
166 REM: 1657, 1658, 1659, 1660
167 REM: 1661, 1662, 1663, 1664
168 REM: 1665, 1666, 1667, 1668
169 REM: 1669, 1670, 1671, 1672
170 REM: 1673, 1674, 1675, 1676
171 REM: 1677, 1678, 1679, 1680
172 REM: 1681, 1682, 1683, 1684
173 REM: 1685, 1686, 1687, 1688
174 REM: 1689, 1690, 1691, 1692
175 REM: 1693, 1694, 1695, 1696
176 REM: 1697, 1698, 1699, 1700
177 REM: 1701, 1702, 1703, 1704
178 REM: 1705, 1706, 1707, 1708
179 REM: 1709, 1710, 1711, 1712
180 REM: 1713, 1714, 1715, 1716
181 REM: 1717, 1718, 1719, 1720
182 REM: 1721, 1722, 1723, 1724
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184 REM: 1729, 1730, 1731, 1732
185 REM: 1733, 1734, 1735, 1736
186 REM: 1737, 1738, 1739, 1740
187 REM: 1741, 1742, 1743, 1744
188 REM: 1745, 1746, 1747, 1748
189 REM: 1749, 1750, 1751, 1752
190 REM: 1753, 1754, 1755, 1756
191 REM: 1757, 1758, 1759, 1760
192 REM: 1761, 1762, 1763, 1764
193 REM: 1765, 1766, 1767, 1768
194 REM: 1769, 1770, 1771, 1772
195 REM: 1773, 1774, 1775, 1776
196 REM: 1777, 1778, 1779, 1780
197 REM: 1781, 1782, 1783, 1784
198 REM: 1785, 1786, 1787, 1788
199 REM: 1789, 1790, 1791, 1792
200 REM: 1793, 1794, 1795, 1796
201 REM: 1797, 1798, 1799, 1800
202 REM: 1801, 180
```


Open Forum

Summary

100

As the program utilizes user-defined graphics, it will only work with the unexpanded VIC. The main aim of the game is to destroy as many enemy fighter ships as possible in 700 seconds.

The enemy ships appear from the mother ship at the top of the screen. The player aligns the sights on an enemy target and fires.

The sights can be moved in all four directions and once you move the sight cursor it will continue to move until you release the joystick.

When the program is run, it first asks you whether you want instructions or not (press ENTER to continue).

While you are testing the instructions, the computer designs the instructions characters and copies the abstract into RAM.

When this has been completed the PLAM character generator is activated by Line 25. After this is finished the computer draws the alien mother ship and fighters and Lines 85 to 3000 make the fighters move down the screen and also draw the walls.

Lines 4080 to 4090 carry out the firing sequence and also see if you have hit your target. If you hit your target (head on) the computer plays a chaotic tune and awards you 10 points (lines 4090 to 4100).

If you only strike the alien craft a glancing blow the computer only makes an explosion noise and sends you to zero.

If you wish to appear as a speaker, please contact the following person:

Watch counting

100

The object of this program is to train the user in "fast counting" counting groups of a glance without breaking them down into single items.

The program displays a random number of black squares in the top half of the screen in a random pattern. After a few moments these are removed and the user is invited to estimate how many squares were displayed.

After each entered the computer along the correct number and after 10

100

100

```

1  #include <iostream>
2  using namespace std;
3  int main()
4  {
5      int a,b,c,d,e,f,g,h,i,j,k,l,m,n,o,p,q,r,s,t,u,v,w,x,y,z;
6      a=1;b=2;c=3;d=4;e=5;f=6;g=7;h=8;i=9;j=10;k=11;l=12;m=13;n=14;o=15;p=16;q=17;r=18;s=19;t=20;
7      u=21;v=22;w=23;x=24;y=25;z=26;
8      cout<<"abcdefghijklmnopqrstuvwxyz"<<endl;
9      for(int i=0;i<26;i++)
10     {
11         cout<<char(a+i)<<endl;
12     }
13     return 0;
14 }

```


Spectrum

In this new slot various contributors explore different aspects of the ZX Spectrum.

Take a look inside the ZX Spectrum

Stephen Adams lifts the lid off the machine everyone's talking about

The ZX Spectrum is basically a more advanced version of the ZX81 with more RAM memory within the computer and the ability to have colour (plus a limited sound capacity).

There are 14 ICs in the case plus the familiar 1 amp, 9 volt voltage regulator. The eight RAM ICs give a total of 128K using the same chips as used in the Sinclair 128K RAM pack (which is not usable on the Spectrum).

Also included is the transformer (on the top right) which provides -5V , $+5\text{V}$ and $+12\text{V}$ for the RAM chips and is still buzzing away.

The two large chips on the right-hand side are the 128K ROM and the Z80A micro-processor.

Moving to the left we come to two PAL1167 chips which are used when refreshing the RAM, the top one to the left side of these is the Universal Logic Array (ULA) which contains all the electronic bits which control colour display, memory decoding and refreshing.

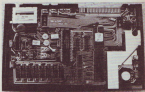
Above the RAM chips is the colour encoding circuitry and its crystal, plus the crystal for the micro-processor which runs at 14MHz. The ULA however divides this down to 3.5MHz before it gets to the Z80A.

These crystals both have capacitor 'trimmers' which can be adjusted to keep the frequency correct and this makes the timing more accurate than the ZX81, which used a ceramic filter to control the frequency.

On the far left-hand side below the video modulator (the metal box) is the PAL encoding IC which allows you to put colours on the TV picture.

At the back are three sockets: +9 volt power (a barrel socket on the review model we had, unlike the Jags Plug socket shown in the picture), SBC and EAR sockets.

There is also the edge connector which now has 26 metal strips on both sides, unlike the ZX81 which only had



What you get when you take the cover off the new ZX Spectrum.

ZX. This means that only input/output ports 'may' work on the Spectrum.

The memory map is entirely used up by the ROM and RAM and only the ROM CS line appears on the edge connector. This means that any memory mapped devices will have to be redesigned.

The edge connections are shown below and the ones that are different from the ZX81 are marked with an asterisk.

Type of connector	Status of connector
1 25-pin	25-pin
2 4-pin	4-pin
3 12-pin	12-pin
4 16-pin	16-pin
5 16-pin	16-pin
6 16-pin	16-pin
7 16-pin	16-pin
8 16-pin	16-pin
9 16-pin	16-pin
10 16-pin	16-pin
11 16-pin	16-pin
12 16-pin	16-pin
13 16-pin	16-pin
14 16-pin	16-pin
15 16-pin	16-pin
16 16-pin	16-pin
17 16-pin	16-pin
18 16-pin	16-pin
19 16-pin	16-pin
20 16-pin	16-pin
21 16-pin	16-pin
22 16-pin	16-pin
23 16-pin	16-pin
24 16-pin	16-pin
25 16-pin	16-pin
26 16-pin	16-pin
27 16-pin	16-pin
28 16-pin	16-pin
29 16-pin	16-pin
30 16-pin	16-pin
31 16-pin	16-pin
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34 16-pin	16-pin
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36 16-pin	16-pin
37 16-pin	16-pin
38 16-pin	16-pin
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40 16-pin	16-pin
41 16-pin	16-pin
42 16-pin	16-pin
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46 16-pin	16-pin
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Programming

Keys which unlock the most potential

Nick Hampshire tells you how to get the most from VIC-20's function keys

On the right-hand side of the VIC-20 keyboard there are four special keys known as function keys. By using these keys in both shifted and unshifted mode they can be used to define up to eight different functions.

Unfortunately Commodore has not provided any basic commands on the standard VIC to utilise these keys, you must consequently develop your own routines.

In order to use the function keys one needs to understand the way in which the VIC system software detects a key depression. The VIC does this with a keyboard scanning routine which is called 60 times per second by an interrupt generated by one of the internal timers on the VIC chips.

The keyboard scanning routine is very simple and scans all the keys,



Keys... to greater options

indicating the four function keys, looking for a key which has been pressed. The keyboard is organised as an 8x8 matrix with the keys at the intersection points of the vertical and horizontal lines.

The vertical lines are connected to an eight-line output port and the hori-

zontal lines to an eight-line input port. If a key is pressed then an output line is connected to an input line, with just one combination of input/output line for every key.

To scan the keyboard the computer sets just one of the output lines at a time low, while keeping the rest high, then tests the input port to see if any of the input lines are low. This is repeated eight times for each output line.

If one of the input lines is found to be low then a key depression is detected and the keyboard scanning software determines which key was pressed.

This key is first assigned a number which is stored in location 293 prior to being decoded by the input routine and given an ASCII code value.

When dealing with the function keys we are interested in the value stored in location 293, we are also interested in the status of the shift key, this is stored in location 562.

Learning the values

By looking at the contents of location 293 we find that the function keys have been assigned the following values, remember that the value in 293 for the shifted and unshifted key will be the same:

function key #1 & #2 — 99
function key #3 & #4 — 47
function key #5 & #6 — 55
function key #7 & #8 — 63

The shift key in location 650 has the following status:

shift unpressed — 0
shift pressed — 1
CBM pressed — 3
CBM and shift pressed — 1

The routine (see), uses these values to test which function key has been pressed. It should be noted that although the VIC is only designed to have eight function keys this could be increased to 12 or even 16 by using the CBM and CBM shift keys in addition to pressing one of the four function keys.

This would mean that each function key could have up to four different assignments depending on whether the shift, CBM or both were also pressed.

```

1 REM #ROUTINE TO TEST WHICH FUNCTION
2 REM #KEY HAS BEEN PRESSED
3 REM
4 REM
5 REM #WHICH KEY PRESSED?
6 REM
7 GOSUB(293)
8 REM
9 REM #SHIFT KEY DOWN?
10 REM
11 GOSUB(650)
12 REM
13 REM #DECODE KEY NUMBER
14 REM
15 GOTO 16
16 REM
17 REM #DECODE KEY NUMBER
18 REM
19 REM
20 REM
21 IF A=99 THEN B=1 : GOTO 26
22 IF A=47 THEN B=3 : GOTO 26
23 IF A=55 THEN B=5 : GOTO 26
24 IF A=63 THEN B=7 : GOTO 26
25 GOTO 16
26 IF B=1 THEN B=3
27 B=B+2
28 PRINT "FUNCTION KEY "B" PRESSED"
29 GOTO 26

```


Sound & vision



Giving soul to electronic music

Microcomputer-based musical instruments are appearing all over the place these days. In the music charts, a number of performers use them as an integral part of their sound. Others have their sound based on micro-generated music.

Depeche Mode is one group who use fast sequences to provide a backing for their imaginative new pop.

At the other end of the spectrum are big international stars like Vangelis who create cinematic themes made for the film *Chariot Of Fire*, and the Pop Machine Jean-Michel Jarre, whose *Omnico Concerto* was recently played on television.

Critics say that this kind of electronic music has no soul. But anything based on the output of a microcomputer has not got

expression. This is of course denied by the music the performers produce.

Most professional electro-musicians have very expensive equipment which enables them to express musical ideas fully. It is possible to use some of their techniques at home, to produce more interesting computer music.

There are a number of qualities that go to make up what we refer to as music. Harmony, rhythm and timbre are the main ones.

The timbre of a sound is closely related to its volume envelope. On a synthesiser there is often a set of controls referred to as envelopes. It can be used to control the amplitude of the complete sound, having independently the initial depression of a key.

It is a similar way it can be used to control the amount of fading given to the sounds present at the output of the mixer.

Of course some synthesizers allow you to control both the volume and the fading with the envelopes, although only the most expensive machines allow you to define separate envelopes for each.

The Roland SM-50 synthesiser even allows you to define the pulse-width with the envelopes, creating interesting "grated" effects.

The timbre of a sound is the shape of the wave of a sound. The wave is the one that defines the pitch of the sound, and it has a shape that contains other frequencies giving it a distinct sound.



Remember... Jean Michel Jarre

For example, a simple square wave sounds a little like a woodwind instrument, a sawtooth wave like brass instruments.

On a sophisticated machine the timbre envelope can be defined just like the others. Thus an envelope varies a quantity over a time.

Here is the usual outline of a program that defines a volume envelope on the VIC-20.

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1130 GOTO 1140  
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1160 GOTO 1170  
1170 GOTO 1180  
1180 GOTO 1190  
1190 GOTO 1200  
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Popular Computing Weekly.
The fast one.

Hand & mouth

by
JOHN SAWYER
 THE THIRD BRANCH OF THE TRIO



Sharp's mini goes for the wallet

Sharp, the Japanese-based calculator firm, has just launched what must be the most advanced mini-calculator-computer on the market.

Equipped with the new graphics-based interface, the mini-computer comes in a brown leatherette-cased shell which would slot over it into a Texas's pocket. The PC 1000 supermini, and at first glance looks identical to the PC 1201.

The total amount of random access-memory has been increased to 8.1K (as opposed to the 1201's 1.2K) with 1000 bytes available in basic program and data memory.

The RAM can be expanded by the addition of a 1K or 6K CMOS memory

module, and programs stored on up to two cassette tape cartridges simultaneously.

Last year's sleeker the false impression that this is just a PC 1201 mask. Two let me point out the significant differences.

The new standard Sharp COMFORTY keyboard has an very useful coin-defensible keys which can be operated as anything from numerical function and command keys to the control of games on the display. The latter is possible on the 2 x 156 dot liquid crystal display since each dot is individually addressable, leading to Sharp's advertising of a "multi-graphic display area".

There are a host of new basic commands available to the user which especially improve using handling and enable two-dimensional array manipulation. Some of the new commands are directed to-

wards the C21 100 printer which gives the best output I've seen from a "pocket" model.

The secret lies in a really quite advanced but colour graphic package which enables the user to choose any different sizes of characters and lines ranging from four to 361 dots in length.

Usually any pattern may be displayed on the 56mm wide paper as the printing head can be controlled completely in all four directions.

Of course there's always a hitch somewhere. In this case it is the price, which though unduly justifiable, turns the machine into the range of the micro-computer. At around £150 for the basic model unit (a similar sum for the printer cassette interface I'd give my neck out and go for a micro).

John Sawyer



Sharp's PC 1000 pocket computer with printer and printer-cassette interface



Just remember... you are human!

Last week's questions should help you to examine assembler programs more critically and in this week's article I describe some more points to watch out for. Remember you are unlikely to need all the features that could be included.

Anyway, the word processor I use to write with, is over seven kilobytes of machine code assembled from more than 3,500 lines of source-code. The assembler I used is quite simple and I don't use all of its facilities in the seven months it took to construct *Human*.

Let me repeat one key idea from last week — the human factors in the engineering of the assembler are crucially important. You will spend a great deal of

time using source code and editing, assembling, and correcting after the first test assembly.

How easy are the controls to move the screen window over the source-code text in memory? Ideally you should be able to use one single keystroke to move down the listing and another to move up.

Can you enter the number of lines that you move in one bound, for example?

Can you insert letters and words into a line of text or must you type the line again after it?

You will like to delete one line of the program but can you also delete a block of lines and a method for doing that easy to remember and carry out?

Is it possible to copy one or more lines from one part of the program to another? This facility is the basis of a macro-assembler and I will write more about that later.

Will the assembler cope with different number bases, that is, can you enter numbers in decimal, hexadecimal and octal notation? The first two bases are the most important for microcomputers now current in this country.

To which base does the assembler default? If you are familiar with hexadecimal for addressing Random Access Memory (RAM) then you will find octal very strange and vice versa.

Some assembler programs allow you to write a mathematical expression in place of the operand. That is the address or label following the CPU instruction. The Macrocode Software assembler allows you to add or subtract whole 256's often addition, subtraction, multiplication, division, and logical AND and OR.

How easy is it to define bytes and words that you wish to use as constant numbers and variables in your program? For example the *Human* Software assembler for the Targemore uses the following "labelled" code that is an instruction that is recognised by the assembler but which is not in the CPU instruction set among others.

MOV — Defines a single byte value in memory at 20 Hex, which equates to 32000 on the V20.

MOV — Defines a two byte value at 20000 Hex, the start of the *Human* monitor.

MOV — This instruction assigns a value to a label. For example, the instruction

MOV 20000

followed in the course of the program by the instruction

JMP 20000

would cause the assembler to generate machine code that will jump to a sub-routine entry address 32768 Hex.

John Sawyer

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Peek & poke

Peek your problems to our address, Ian Boardman will poke back an answer.

AND A BIG, BIG HAND FOR THE WINNER!

Michael Fraser of Stone Lane, Essex, writes:

Q I have a "BIB" Model B Microcomputer and have written a number of games in which the computer plays against me. What else, though, is better in accept such low-key games as "TOD", "BOM", "CON", "RATA", "ILLUSTRATION" while I find a hi-down at the end of a long game. Could you suggest a way, or ways, of ending the program more dramatically, please?

A If you add the following routine, or some variation, to the end of your program, it will print an outline version of the word "Congratulations!" in clear block, randomly coloured letters, at random positions on the screen, while at the same time making an extraordinary cacophonous noise. It is a variation of what comes at the end of:

- 10 PRINT "CONGRATULATIONS!"
- 20 GOTO 10
- 30 PRINT "CONGRATULATIONS!"
- 40 GOTO 30
- 50 PRINT "CONGRATULATIONS!"
- 60 GOTO 50
- 70 PRINT "CONGRATULATIONS!"
- 80 GOTO 70
- 90 PRINT "CONGRATULATIONS!"
- 100 GOTO 90
- 110 PRINT "CONGRATULATIONS!"
- 120 GOTO 110
- 130 PRINT "CONGRATULATIONS!"
- 140 GOTO 130
- 150 PRINT "CONGRATULATIONS!"
- 160 GOTO 150
- 170 PRINT "CONGRATULATIONS!"
- 180 GOTO 170
- 190 PRINT "CONGRATULATIONS!"
- 200 GOTO 190
- 210 PRINT "CONGRATULATIONS!"
- 220 GOTO 210
- 230 PRINT "CONGRATULATIONS!"
- 240 GOTO 230
- 250 PRINT "CONGRATULATIONS!"
- 260 GOTO 250
- 270 PRINT "CONGRATULATIONS!"
- 280 GOTO 270
- 290 PRINT "CONGRATULATIONS!"
- 300 GOTO 290
- 310 PRINT "CONGRATULATIONS!"
- 320 GOTO 310
- 330 PRINT "CONGRATULATIONS!"
- 340 GOTO 330
- 350 PRINT "CONGRATULATIONS!"
- 360 GOTO 350
- 370 PRINT "CONGRATULATIONS!"
- 380 GOTO 370
- 390 PRINT "CONGRATULATIONS!"
- 400 GOTO 390
- 410 PRINT "CONGRATULATIONS!"
- 420 GOTO 410
- 430 PRINT "CONGRATULATIONS!"
- 440 GOTO 430
- 450 PRINT "CONGRATULATIONS!"
- 460 GOTO 450
- 470 PRINT "CONGRATULATIONS!"
- 480 GOTO 470
- 490 PRINT "CONGRATULATIONS!"
- 500 GOTO 490
- 510 PRINT "CONGRATULATIONS!"
- 520 GOTO 510
- 530 PRINT "CONGRATULATIONS!"
- 540 GOTO 530
- 550 PRINT "CONGRATULATIONS!"
- 560 GOTO 550
- 570 PRINT "CONGRATULATIONS!"
- 580 GOTO 570
- 590 PRINT "CONGRATULATIONS!"
- 600 GOTO 590
- 610 PRINT "CONGRATULATIONS!"
- 620 GOTO 610
- 630 PRINT "CONGRATULATIONS!"
- 640 GOTO 630
- 650 PRINT "CONGRATULATIONS!"
- 660 GOTO 650
- 670 PRINT "CONGRATULATIONS!"
- 680 GOTO 670
- 690 PRINT "CONGRATULATIONS!"
- 700 GOTO 690
- 710 PRINT "CONGRATULATIONS!"
- 720 GOTO 710
- 730 PRINT "CONGRATULATIONS!"
- 740 GOTO 730
- 750 PRINT "CONGRATULATIONS!"
- 760 GOTO 750
- 770 PRINT "CONGRATULATIONS!"
- 780 GOTO 770
- 790 PRINT "CONGRATULATIONS!"
- 800 GOTO 790
- 810 PRINT "CONGRATULATIONS!"
- 820 GOTO 810
- 830 PRINT "CONGRATULATIONS!"
- 840 GOTO 830
- 850 PRINT "CONGRATULATIONS!"
- 860 GOTO 850
- 870 PRINT "CONGRATULATIONS!"
- 880 GOTO 870
- 890 PRINT "CONGRATULATIONS!"
- 900 GOTO 890
- 910 PRINT "CONGRATULATIONS!"
- 920 GOTO 910
- 930 PRINT "CONGRATULATIONS!"
- 940 GOTO 930
- 950 PRINT "CONGRATULATIONS!"
- 960 GOTO 950
- 970 PRINT "CONGRATULATIONS!"
- 980 GOTO 970
- 990 PRINT "CONGRATULATIONS!"
- 1000 GOTO 990

HOW DO I POKE THE COLOUR ON MY VIC?

Arminia Evans of Milton Court, London, SE2 writes:

Q I have just had my VIC-20 for a couple of weeks and have had great difficulty understanding the information given in the manual on how to put colour where I want it on the screen. I know about peek and poke at school, using a Z80, but what this book tells there doesn't seem of any use whatsoever in getting colour on to the screen. I would be pleased if you could indicate how the whole thing works, as I believe PEEK and POKE are much better ways of manipulating the screen than just using PRINT statements.

A The simplest way to poke colour into the screen — keeping in mind that you must

peek a character into the screen using one set of addresses, and then poke the colour for that character into place with what appears to be a completely different set of addresses — is to realise that there is a clear mathematical relationship between the two addresses. As you can tell from the charts in the back of your manual, the first screen address is 7680 for peaking characters, while the first screen address for colour is 8192, ie 512*16.

I suggest you work out your program just using the character codes, and once that is working satisfactorily without colour, add the colour PEEK statements, working them out by adding 512*16. Another way of doing this is to put both screens within a loop.

Enter and run the following routine, which comes from the book *Amiga For A Million* by Computer and you'll see the process at work. It takes a day to run on PEEK 50, but on PEEK 500 it takes 10 minutes.

MEMORIES ARE MADE OF THIS, PART ONE

Michael Adams of Highbury Grove, Warrington, writes:

Q I have read three times to date of apparent poke, however people have had with both pokes on their Z80s. Have there been problems or is there a consistent problem with the RAM poke? I want to know before I spend £25.00 — which I have barely afford — on a Sinclair memory pack.

A The Sinclair (Mk. 1) pack has, it is true, had problems had previous to the point due to its build of — it stores data — dumping everything on you for the program, appearing as "labels" as variables are encountered, or even actually taking off the back of the Z80, while you are attempting to program.

Most of these problems can be overcome by removing the back of the RAM pack so it stays cool, cleaning the contacts with surgical spirit before you attach the memory, and using the back of a similar

product to finally fix the pack in place.

If you are not willing to go to these lengths — and there are many owners of IBM RAM packs bought from Sinclair who have not had to do such things — you could buy a memory expansion kit from someone else. First ask yourself how much memory you really need. *Quadrant*, among others, supply a very cheap — priced £17 — 34 pins which makes the computer much more useful than it is with just the IC.

If you need more, you could choose from a number of reputable suppliers, which include Phoenix Marketing (£24.95 for 128K, 128K Software £25), and Dr. Thomas (£24.95 — £25.95, £26 — £27.95, £28 — £29.95).

MEMORIES ARE MADE OF THIS, PART TWO

Geoff Kent of Highbury Way, London NW9 writes:

Q Why are BASIC statements used in programs at the start, when they don't do anything?

A A BASIC statement at the start of a program is used to set a storage space for a machine code routine. Because the computer ignores BASIC statements, it effectively starts the program at the first non-comment statement. Information in the BASIC statement can then be ignored later. BASIC statements are usually put at the start of a program, because there is nowhere else to store within the RAM. The space they create is therefore always in the same place, which of course makes it much easier to use.

PRINT 'THIS IS THE WHITE ADDRESS'

David Blair of The Bell, Addiscombe, Kent writes:

Q I want to send back my printer because I think it is faulty, but though Sinclair Research is based in Cambridge, they have another address in Canterbury, Surrey. To which address should I send my printer?

A The address you want is Sinclair Research (UK),

Stanhope Road, Canterbury, Surrey, GU2 8PS. This is the address of Sinclair's mailing company which deals with all dispatch and returns. In fact I gave out this address a couple of weeks ago, so you might well know it by now.

A BIGGER APPETITE MEANS BIGGER BITES

Early Stewart of 168 Elm Lane, Windsor writes:

Q Is it true that programs on the Z80 are a great many more bytes than the same programs on the Z800?

A In many cases yes. The program below will use more than twice the number of bytes on the Z80 than on the Z800. Even with careful programming it is virtually impossible not to use more bytes on the Z800.

10 LET A=0
20 FOR I=0 TO 255
30 LET C=NOT C
40 LET C=NOT C
50 LET C=NOT C
60 LET C=NOT C
70 LET C=NOT C
80 LET C=NOT C
90 LET C=NOT C
100 LET C=NOT C
110 LET C=NOT C
120 LET C=NOT C
130 LET C=NOT C
140 LET C=NOT C
150 LET C=NOT C
160 LET C=NOT C
170 LET C=NOT C
180 LET C=NOT C
190 LET C=NOT C
200 LET C=NOT C
210 LET C=NOT C
220 LET C=NOT C
230 LET C=NOT C
240 LET C=NOT C
250 LET C=NOT C
260 LET C=NOT C
270 LET C=NOT C
280 LET C=NOT C
290 LET C=NOT C
300 LET C=NOT C
310 LET C=NOT C
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330 LET C=NOT C
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470 LET C=NOT C
480 LET C=NOT C
490 LET C=NOT C
500 LET C=NOT C
510 LET C=NOT C
520 LET C=NOT C
530 LET C=NOT C
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550 LET C=NOT C
560 LET C=NOT C
570 LET C=NOT C
580 LET C=NOT C
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600 LET C=NOT C
610 LET C=NOT C
620 LET C=NOT C
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730 LET C=NOT C
740 LET C=NOT C
750 LET C=NOT C
760 LET C=NOT C
770 LET C=NOT C
780 LET C=NOT C
790 LET C=NOT C
800 LET C=NOT C
810 LET C=NOT C
820 LET C=NOT C
830 LET C=NOT C
840 LET C=NOT C
850 LET C=NOT C
860 LET C=NOT C
870 LET C=NOT C
880 LET C=NOT C
890 LET C=NOT C
900 LET C=NOT C
910 LET C=NOT C
920 LET C=NOT C
930 LET C=NOT C
940 LET C=NOT C
950 LET C=NOT C
960 LET C=NOT C
970 LET C=NOT C
980 LET C=NOT C
990 LET C=NOT C
1000 LET C=NOT C

HERE'S A BUNCH OF 500 CHARACTERS

Ray Kent of Ashbur Lane, Maiden, Essex writes:

Q Is there a program that shows you the use of characters without a Z80? I got fed up looking through books to find the list of them.

A Try the following . . .

- 10 LET A=0
- 20 FOR I=0 TO 255
- 30 LET C=NOT C
- 40 LET C=NOT C
- 50 LET C=NOT C
- 60 LET C=NOT C
- 70 LET C=NOT C
- 80 LET C=NOT C
- 90 LET C=NOT C
- 100 LET C=NOT C
- 110 LET C=NOT C
- 120 LET C=NOT C
- 130 LET C=NOT C
- 140 LET C=NOT C
- 150 LET C=NOT C
- 160 LET C=NOT C
- 170 LET C=NOT C
- 180 LET C=NOT C
- 190 LET C=NOT C
- 200 LET C=NOT C
- 210 LET C=NOT C
- 220 LET C=NOT C
- 230 LET C=NOT C
- 240 LET C=NOT C
- 250 LET C=NOT C
- 260 LET C=NOT C
- 270 LET C=NOT C
- 280 LET C=NOT C
- 290 LET C=NOT C
- 300 LET C=NOT C
- 310 LET C=NOT C
- 320 LET C=NOT C
- 330 LET C=NOT C
- 340 LET C=NOT C
- 350 LET C=NOT C
- 360 LET C=NOT C
- 370 LET C=NOT C
- 380 LET C=NOT C
- 390 LET C=NOT C
- 400 LET C=NOT C
- 410 LET C=NOT C
- 420 LET C=NOT C
- 430 LET C=NOT C
- 440 LET C=NOT C
- 450 LET C=NOT C
- 460 LET C=NOT C
- 470 LET C=NOT C
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- 600 LET C=NOT C
- 610 LET C=NOT C
- 620 LET C=NOT C
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- 640 LET C=NOT C
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- 680 LET C=NOT C
- 690 LET C=NOT C
- 700 LET C=NOT C
- 710 LET C=NOT C
- 720 LET C=NOT C
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- 770 LET C=NOT C
- 780 LET C=NOT C
- 790 LET C=NOT C
- 800 LET C=NOT C
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- 820 LET C=NOT C
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- 850 LET C=NOT C
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- 880 LET C=NOT C
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- 900 LET C=NOT C
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- 920 LET C=NOT C
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- 940 LET C=NOT C
- 950 LET C=NOT C
- 960 LET C=NOT C
- 970 LET C=NOT C
- 980 LET C=NOT C
- 990 LET C=NOT C
- 1000 LET C=NOT C

This does what you want it to do, but there is a lot more scope if you add the following:

10 LET A=0
20 FOR I=0 TO 255
30 LET C=NOT C
40 LET C=NOT C
50 LET C=NOT C
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970 LET C=NOT C
980 LET C=NOT C
990 LET C=NOT C
1000 LET C=NOT C

Send your questions to *Peek & Poke*, Popular Computing Weekly, Matthews Court, 29 Richmond Street, London WC2 8EF.

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FLORIDA 33304, U.S.A.



"Give me one good reason why I should choose a VIC 20 home computer."

1. VIC is outstanding value for money. No other colour home computer can give so much for under £200.
2. Total standard memory 25K, made up of 10K ROM and 8K RAM.
3. Fully expandable to 27K user RAM.
4. Microsoft Basic interpreter as standard.
5. Accessible machine language via plug-in cartridges.
6. Connects direct to monitor or standard television.
7. Full size typewriter style keyboard.
8. Full colour and sound.
9. All colours easily accessible.
10. 62 predefined graphic characters direct from the keyboard.
11. Full set of upper and lower case characters.
12. 256 displayable characters direct from the keyboard.
13. High resolution graphics capability via plug-in cartridges.
14. Programmable function keys can be used with plug-in cartridges.
15. Automatic repeat on cursor function keys.
16. User definable input/output port.
17. Machine bus port for memory expansion and ROM software.
18. Standard interfaces for hardware peripherals.
19. VIC 20 is truly expandable into a highly sophisticated computer system with a comprehensive list of accessories (see panel below).
20. Full range of software for home, education, business and entertainment on disk, cassette and cartridge.
21. Books, manuals and learning aids from 'Teach Yourself Basic to the VIC', programmers' reference guide (a must for advanced programmers).
22. Full support for VIC owners - their own magazine 'VIC Computing' as well as a national network of VIC user groups.
23. National dealer network providing full service and support to VIC owners.
24. Expertise and experience - Commodore are world leaders in microcomputer and silicon chip technology.
25. Commodore is the leading supplier of microcomputers in the UK to business, schools, industry and the home.
26. VIC 20 is the best-selling colour home computer in the UK.

How many reasons was it you wanted!

Accessories and books

- Teach Yourself Basic
- Single-line or floppy disk based BASIC user manuals
- VIC 20 manuals for owner, printer
- 1K, 4K and 8K RAM expansion cartridges
- Programming and pack-in machine code magazine, cassette, programmer's reference card, high resolution graphics cartridge

- Plug-in expansion bus for a full 10K, 20K or 27K ROM (VIC including Parallel expansion)
- 1K, 4K, 8K, 16K, 32K, 64K, 128K, 256K, 512K, 1024K, 2048K, 4096K, 8192K, 16384K, 32768K, 65536K, 131072K, 262144K, 524288K, 1048576K, 2097152K, 4194304K, 8388608K, 16777216K, 33554432K, 67108864K, 134217728K, 268435456K, 536870912K, 1073741824K, 2147483648K, 4294967296K, 8589934592K, 17179869184K, 34359738368K, 68719476736K, 137438953472K, 274877906944K, 549755813888K, 1099511627776K, 2199023255552K, 4398046511104K, 8796093022208K, 17592186044416K, 35184372088832K, 70368744177664K, 140737488355328K, 281474976710656K, 562949953421312K, 1125899906842624K, 2251799813685248K, 4503599627370496K, 9007199254740992K, 18014398509481984K, 36028797018963968K, 72057594037927936K, 144115188075855872K, 288230376151711744K, 576460752303423488K, 1152921504606846976K, 2305843009213693952K, 4611686018427387904K, 9223372036854775808K, 18446744073709551616K, 36893488147419103232K, 73786976294838206464K, 147573952589676412928K, 295147905179352825856K, 590295810358705651712K, 1180591620717411303424K, 2361183241434822606848K, 4722366482869645213696K, 9444732965739290427392K, 18889465931478580854784K, 37778931862957161709568K, 75557863725914323419136K, 151115727451828646838272K, 302231454903657293676544K, 604462909807314587353088K, 1208925819614629174706176K, 2417851639229258349412352K, 4835703278458516698824704K, 9671406556917033397649408K, 19342813113834066795298816K, 38685626227668133590597632K, 77371252455336267181195264K, 154742504910672534362390528K, 309485009821345068724781056K, 618970019642690137449562112K, 1237940039285380274899124224K, 2475880078570760549798248448K, 4951760157141521099596496896K, 9903520314283042199192993792K, 19807040628566084398385987584K, 39614081257132168796771975168K, 79228162514264337593543950336K, 158456325028528675187087900672K, 316912650057057350374175801344K, 633825300114114700748351602688K, 1267650600228229401496703205376K, 2535301200456458802993406410752K, 5070602400912917605986812821504K, 10141204801825835211973625643008K, 20282409603651670423947251286016K, 40564819207303340847894502572032K, 81129638414606681695789005144064K, 162259276829213363391578010288128K, 324518553658426726783156020576256K, 649037107316853453566312041152512K, 1298074214633706907132624082305024K, 2596148429267413814265248164610048K, 5192296858534827628530496329220096K, 10384593717069655257060992658440192K, 20769187434139310514121985316880384K, 41538374868278621028243970633760768K, 83076749736557242056487941267521536K, 166153499473114484112975882535043072K, 332306998946228968225951765070086144K, 664613997892457936451903530140172288K, 1329227995784915872903807060280344576K, 2658455991569831745807614120560689152K, 5316911983139663491615228241121378304K, 10633823966279326983230456482242756608K, 21267647932558653966460912964485513216K, 42535295865117307932921825928971026432K, 85070591730234615865843651857942052864K, 170141183460469231731687303715884105728K, 340282366920938463463374607431768211456K, 680564733841876926926749214863536422912K, 1361129467683753853853498429727072845824K, 2722258935367507707706996859454145691648K, 5444517870735015415413993718908291383296K, 10889035741470030830827987437816582766592K, 21778071482940061661655974875633165533184K, 43556142965880123323311949751266331066368K, 87112285931760246646623899502532662132736K, 174224571863520493293247799005065324265472K, 348449143727040986586495598010130648530944K, 696898287454081973172991196020261297061888K, 1393796574908163946345982392040522594123776K, 2787593149816327892691964784081045188247552K, 5575186299632655785383929568162090376495104K, 11150372599265311570767859136324180752990208K, 22300745198530623141535718272648361505980416K, 44601490397061246283071436545296723011960832K, 89202980794122492566142873090593446023921664K, 178405961588244985132285746181186892047843328K, 356811923176489970264571492362373784095686656K, 713623846352979940529142984724747568191373312K, 1427247692705959881058285969449495136382746624K, 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3450873173395281893717377931138512726225554486085193268574062320287744K, 6901746346790563787434755862277025452451108972170386537148124640575488K, 13803492693581127574869511724554050904902217944340773074296249281150976K, 27606985387162255149739023449108101809804435888681546148592498562301952K, 55213970774324510299478046898216203619608871777363092297184997124603904K, 110427941548649020598956093796432407239217743554726184594369994249207808K, 220855883097298041197912187592864814478435487109452369188739988498415616K, 441711766194596082395824375185729628956870974218904738377479976996831232K, 883423532389192164791648750371459257913741948437809476754959953993662464K, 1766847064778384329583297500742918515827483896875618953509919907987324928K, 3533694129556768659166595001485837031654967793751237907019839815974649856K, 7067388259113537318333190002971674063309935587502475814039679631949299712K, 14134776518227074636666380005943348126619871175004951628079359263898599424K, 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